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it has found lodgment, but some other factor — as yet undiscovered — than diminished supply of food and of oxygen, reduction of locomotion, or limitation of growth by pressure, is involved in its production. Whatever the cause, it operates by stopping cell growth and division. The dwarfs are not a permanent race, but are constantly recruited from the young of the giants. A few specimens have been found whose shell structure indicates the growth of a typical form from the dwarf condition in consequence of a change to a more roomy home. The dwarfs are what they are by reason of external conditions and not of inheritance. They present a “physiological variety” in which the shape and size of the body, as well as the number of cells in the entire organism, are modified by the direct action of the environment. There is no evidence that these modifications have become heritable. Sexual dimorphism is also well marked in *C. plana*, the average female being about fifteen times as large as the average male. As in the case of the dwarfs, the smaller size is due to the smaller number of cells in the body. Measurements of individual cells of the intestine, stomach, liver, kidney, muscles, and epithelium show that cell size remains the same in the male and female. Whatever the ultimate cause of the smaller size of the male, it operates, as in the dwarf, by causing a cessation of cell growth and division.

C. A. K.

**British Entomostraca.** — The natural history of the fresh-water Entomostraca of Epping Forest, a woodland tract of 35,000 acres, is given by Mr. D. J. Scourfield,<sup>1</sup> from observations extending through a number of years. The author records 102 species, the most complete local list hitherto published for the British Isles, from which a total of 190 species has been reported. One American form, *Ceriodaphnia scitula* Herrick, and several continental species are reported for the first time from this region. The cosmopolitan distribution of this group is further emphasized by the fact that, with one or two doubtful exceptions, all British species occur in continental Europe, and most of them have been found in North America, and not a few in South America, South Africa, Australia, and New Zealand. On the other hand, districts of limited extent, with characteristic physical features, oftentimes exhibit great differences in their Entomostracan fauna. Hydrological rather than climatic factors

<sup>1</sup> Scourfield, D. J. The Entomostraca of Epping Forest, with some general remarks on the group, *The Essex Naturalist*, vol. x (1898), pp. 193-210, 259-274, 313-334.

determine to a large extent the distribution of this group. The local and seasonal occurrence of each species is given in tabulated form. The Cladocera reach their maximum development, as regards species, in September, and their minimum in January. The Ostracoda exhibit two maxima in March and in September, the latter being more marked, and two minima in August and in January. The Copepoda exhibit but a slight variation in the number of species during the year, though there is some suggestion of maxima and minima similar to those detected among the Ostracoda. The seasonal distribution of males and ehippial females of the Cladocera is given for 34 species. In this group, considered as a whole, there are two seasons of sexual activity, the first reaching a maximum in May and affecting only 10 species, and the second extending throughout the autumn months, culminating in October, and affecting 30 species. Thus in the majority of the species the period of sexual activity is confined to the autumn months, though a small number is affected during both seasons, and a few exhibit but a single annual period in the spring. In only a single species, *Daphnia longispina*, does sexual reproduction continue from May to October. Colonies of a given species found in different aquatic habitats may present marked differences in sexual activity, the size of the body of water seeming to be correlated with the variations. Thus males and ehippial females of *Simocephalus vetulus* have been found in the spring only, in tiny pools and ditches, and again in the fall in bodies of water of slightly larger size, while no trace of either sexual form was observed in a larger pond examined repeatedly during a period of three years. The author is inclined to attribute these differences to the direct action of the environment.

A second paper<sup>1</sup> by the same author deals with the biology of a common water-flea in an interesting way. A respiratory function is assigned to the anal cæcum, a thin-walled triangular sac, with glandular cells in the dorsal wall. It is constantly dilating and contracting, and produces a circulation of water that suggests its respiratory function. As in the Cladocera generally, parthenogenesis prevails with alternating periods of sexual activity. The sexually mature female produces the so-called winter or resting eggs, which, unlike the parthenogenetic or summer eggs, require fertilization in order to develop. The ehippium, which carries the resting egg, is formed in Chydorus from the cast-off shell, which is somewhat thickened,

<sup>1</sup> Scourfield, D. J. Chydorus sphaericus, *The Annual of Microscopy* (1898), pp. 62-67, 1 plate.

especially along the posterior margin. The author suggests the name proto-ephippium for this primitive protective covering of the resting egg. This structure is formed quite independently of fertilization, but before the resting eggs leave the ovaries and are transferred to the ephippium it is necessary that they be fertilized. In the absence of the male the empty ephippium is cast off and resting egg retained. If fertilization does not ensue, this process may be repeated several times in succession, as Weismann has already shown for the larger Cladocera. Some of the secondary sexual characters of the male, as, for example, the form of the intromittent post-abdomen, are not assumed until the last molt preceding the adult condition, the structure preceding this molt being of the female type. Attention is called to the cosmopolitan distribution of the species, and to its preference for small bodies of water rich in vegetation. It is, however, not infrequently found in our largest American lakes. Like some other Cladocera, Chydorus exhibit two periods of sexual activity in each year, one in April and May, the other in November and December; the former is the more important, and affects only those individuals found in small ponds likely to be dried up during the summer, while the latter is confined to colonies in larger bodies of water. It seems probable that some colonies may never have a sexual period at all; at least some large ponds most thoroughly examined never once yielded a male or an ephippial female.

C. A. K.

**Rotifers of the Leman.** — The first part of a superbly illustrated monograph of the rotiferan fauna of this Swiss lake and its neighborhood has been published by Dr. Weber.<sup>1</sup> Owing to the absence of swamps and small bodies of water in this alpine environment the number of species recorded is not so great as in England or in Germany, though a very extensive list is presented. Each species is briefly described, the synonymy and the bibliography are given, and figures, often in natural colors, are liberally provided. The males and resting eggs are illustrated in some instances. We regret the absence of references to several important American lists in the bibliographies of the various species. American workers on this group will, however, find the paper of much interest, as many of the species figured are abundant in this country.

C. A. K.

<sup>1</sup> Weber, E. F. Faune rotatorienne du bassin du Léman, *Revue Suisse de Zool.*, tome v (1898), pp. 263-354, Pls. X-XV.